GROWTH IMPROVEMENT OF F_1 GENERATION OF *CLARIAS GARIEPINUS* THROUGH SELECTIVE BREEDING.

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ABSTRACT:

Selective breeding studies were carried out in four genetic mating combinations of *Clarias gariepinus* with the aim of improving its growth performance. F_2 intraspecific and backcross were produced using the best male and female of the best genetic mating combination in the F_1-generation in crosses of three wild strains of *Clarais gariepinus*. The highest percentage hatchability (75%) was recorded in female Kainji parental and male Kainji F_1 and the least (53.67%) in female and Male Kainji F_1. The cross involving female Kainji F_1 and Male Kainji Parental had the best survival (49%) indoor and also best (38.67%) outdoor, while the least (37.67%) was recorded in female Kainji parental and Male Kainji F_1 and also gave the least (32.67%) outdoor. The female Kainji F_1 and male Kainji parental gave the best growth performance (1.61g) at 19 days indoor rearing, while female and male Kainji parental gave the least (1.50g). At the end of seven months rearing outdoor, the female Kainji parental and male Kainji F_1 gave the best growth performance of (222.49g) and the least (180.66) was recorded in female Kainji F_1 and male Kainji parental.

INTRODUCTION

Fish farming is the world's fastest-growing sector of agriculture business. Although, aquaculture started in ancient times in china and the far East, an unprecedented expansion has occurred throughout the world in recent decades (Gjedrem, 1997). New species and new rearing technologies have been introduced and some of the species have shown great potential. The Clariidae along with the various tilapiine species constitute the most important aquaculture species in Africa (Teugels *et al;* 1992). Generally, *Heterodbranchus* and *Clarias* species are leading freshwater candidates for aquaculture in Africa. The African Catfish, *C. gariepinus* is farmed mainly in Africa and Europe and of late in India, china, Brazil and some East European Countries (Huisman and Richter, 1987).

Although fish farming has a long history and fish farmers have been selecting broodstock for a long time, systematic and scientifically sound selection procedures has been adopted only in recent years and this too is only in respect to a very limited number of species, such as the common carp (*Cyprinus carpio*) and some salmonids. Extensive selection of ornamental fish has been carried out in many parts of the world, but since such selection has been exclusively for ornamental traits, it has little significance in relation to selective breeding of food fish (FAO, 1972). In Africa, Selective breeding of tilapias has been mainly aimed at increasing their growth rate so that farmer can realize quicker and higher yields. In other parts of the world, selection has also been

done for skin colour, body conformation, fillet yield and cold tolerance (Behrends *et. al;* 1982; 1990; Fitzsimons, 2000 cited by Changadeya *et al;* 2003. Selective breeding is currently being used in national research institution in Coted d'Ivoire, Egypt, Ghana, Malawi to improve local species and strains of tilapias (Gupta *et al;* 2001).

Selective breeding can ameliorate the problem of poor or slow growth rate among cultured species. This study was therefore designed to identify the F_1 and back-cross with the best superior growth and to evaluate the potential benefit of selective breeding of *Clarias gariepinus* to aquaculture.

MATERIALS AND METHODS

This study was conducted at the Fish Biotechnology Research Laboratory of the National Institute for Freshwater fisheries Research (NIFFR) situated in New Bussa, Borgu Local Government Area of Niger State, Nigeria.

The parental catfishes used in this experiment were the parental of Kainji strain and the F_1-generation of Kainji strain of *Clarias gariepinus* which gave the best growth performance out of the nine mating combination of F_1-generation produced in year 2006.

The gravid males and females were selected. The females of each treatment were weighed and injected with ovaprim hormone intraperitoneally at a dose of 0.5ml per kg of fish weight as recommended by the manufacturers. After the latency period of 12 hours, the males were sacrificed and the two lobes of the testes removed into clean, dry labeled Petri dishes. The females were stripped of eggs after gentle application of pressure on the abdomen to release the eggs into labeled Petri dishes. The testes were then cut open to extract the milt which was used to fertilize the eggs. Saline (0.9% Nacl) solution was added to ensure maximum fertilization. Eggs and milt were then mixed together to generate four genetic mating combinations that will produce F_2-generation as follows:

♀

1. KKF_1 *C. gariepinus* x ♂KK F_1 *C. gariepinus*

♀

2. KKF_1 *C. gariepinus* x ♂ KK Parental *C. gariepinus*

♀

3. KK parental *C. gariepinus* x ♂ KKF_1 *C. gariepinus*

♀

4. KK parental *C. gariepinus* x ♂KK parental C. *gariepinus*

Where, = ♀male; ♂female; KK = Kainji; F_1 = first filial generation.

The fertilized eggs of each cross were spread separately on kakaban (egg collector) and were incubated under consistent aeration using aerators in aquarium tanks (60x30x30cm^3) under ambient temperature of 26-28°C.

After the yolk absorption, fifty fry from each treatment were stocked in each 60x30x30cm^3 aquarium tank, after taking pooled weight and length measurements. Each treatment was triplicate and the fry were fed alibitum with mixed zooplankton collected from NIFFR Natural Fish Food Production Unit, using zooplankton net.

At the lend of nineteen days indoor rearing period, the fry pooled weight and lenght were measured and then transferred to the experimental outdoor concrete tanks (2x2x1m^3) at a stocking density of 10/m^3 (40 fry per tank) in triplicate of the mating combinations. The fry were fed with mixed live zooplankton for one week outdoor and a micronised 40% crude protein supplementary feed at 5% body weight. A random sample of twenty fry of each mating group was collected biweekly for pooled weight and length measurement for two months in outdoor experimental tanks.

At the end of the second stage growth studies, the fingerlings were returned to their

tanks at a stocking density of 5/m^3 (20 fingerlings per tank) and fed with 40% crude protein twice daily. The weight and lenght measurement of each individual fish were measured for seven months in the experimental concrete tanks. At the end of this culture period, the survival of the offspring were estimated. The weight gain and daily weight gain (WG) were calculated using the formulae according to Fagbenro (1996). The data were analyzed statistically.

RESULTS AND DISCUSSION

Table 1: Percentage hatchability and survival of fry indrosses involving F generation of Kainji strain and Kainji Parental of *Clarias gariepinus*

Genetic group f x m	No. of eggs fertilized	Hatchability (%)	Survival indoor (%)	Survival (at outdoor (%)
1. KKF $_1$ X KKF $_1$	500	53.67^b	44.33^{ab}	35.33^{ab}
2. KKF $_1$ X KK parental	500	63.80^b	49.00^a	38.67^a
3. KK parental x KKF$_1$	500	75.00^a	37.67^b	32.67^b
4. KK parental x KK parental	500	56.40^b	46.33^a	35.67^{ab}

Table 1 shows the percentage hatchability and survival in the four mating combinations during the indoor and outdoor rearing. The result of statistical analysis showed significant difference ($P<0.05$) between the crosses interms of percentage hatchability and survival.

The highest percentage hatchability was recorded in the cross involving female Kainji parental strain and male of Kainji F_1-generation (75.00%), while the least (53.67%) was recorded in the cross involving female Kainji F_1-generation and male Kainji F_1-generation. In this study, percentage hatchability showed significant difference ($P<0.05$) between the treatment, but the crosses involving female and male Kaini F_1-generation, female and male Kainji parental and female Kainji F_1 and male Kainji parental are not statistically different in comparison with female Kainji parental and male Kainji F_1-generation which gave the best percentage hatchability. De Graaf *et. al.* (1995) reported 28.4% and 59.1% average hatching percentage in *Clarias gariepinus*. Moses *et. al.* (2005) reported 58.58% hatchability in Kainji strain of *Clarias anguillaris*. However, Legendre *et al.* (1992) reported higher percentage hatchability of 75-85% in *Heterobranchus longifilis*. The highest hatchability of female Kainji parental cross with male Kainji F_1 followed by its reciprocal crosses as shown in table 1 shows that selective breeding may give a better result interms of percentage hatchability.

Table 1 also shows percentage survival of the crosses in both indoor and outdoor rearing. There was significant difference ($P<0.05$) between the treatments in both indoor and outdoor rearing. In the indoor and outdoor rearing, crosses involving female Kainji F_1 and male Kainji parental had significantly ($P<0.05$) highest survival value of 49% and 38.67% respectively. While its reciprocal crosses in both indoor and outdoor gave the lowest survival value of 37.67% and 32.67% respectively. In the same manner, outdoor survival of fry showed that female Kainji F_1 cross with male Kainji Parental gave significantly ($P<0.05$) best survival rate, mean comparison test revealed that the cross is not statistically better than the crosses involving female and male Kainji F_1 and female and male Kainji parental respectively and this crosses are also not better than female Kainji parental and male Kainji F_1 which gave the lowest survival rate (table 1). Although, indoor percentage survival rate showed that cross involving female Kainji F_1 with male Kainji parental had the best survival percentage, statistics showed that among the treatment the cross is not better in percentage

survival compare to the cross involving female and male Kainji F_1 the cross and female and male Kainji parental respectively. However, female and male kainji F_1 is not significantly different from female Kainji parental cross with male Kainji F_1. The survival value recorded in this study both in indoor and outdoor rearing is lower that the survival value of 52.5% reported by Lamai (1999), but similar to 40% reported by Madu *et. al* (1991). Table 1 shows that percentage survival indoor gave better result than survival outdoor. This may be due to controlled conditions indoor which present more opportunities for survival. The lenght increase of the four mating combinations at the end of 7 months is shown in Table 2.

Table 2: Growth performance of the fry of four mating combinations from best 2006 year class intraspecific hybrids reared in door for 19 days.

Mating combination	Initial weight (g)	Final pooled weight (g)	Weight gain (g)	Weight gain/day (g)	Initial pooled length (cm)	Final pooled length (cm)	Lenght increase (cm)	Lenght increase/day (cm)
KKF $_1$ X KKF $_1$	0.088^{b}	1.63^{a}	1.54	0.081	0.18^{b}	1.87^{a}	1.69	0.089
KKF $_1$ X KK parental	0.090^{b}	1.70^{a}	1.61	0.085	0.19^{b}	1.77^{b}	1.58	0.083
KK parental x KKF $_1$	0.101^{a}	1.67^{a}	1.57	0.083	0.22^{a}	1.67^{c}	1.45	0.076
KK parent x KK parental	0.074^{c}	1.57^{a}	1.50	0.079	0.18^{b}	1.64^{c}	1.46	0.077

Table 2 shows a comparison of the weight parameters, initial weight, final weight, weight gain and weight gain per day of all the mating combinations for a period of 19 days indoor. The initial pooled weight showed significant difference between the mating combinations, while the final weight showed no significant difference ($P>0.05$). The female Kainji F_1 and male Kainji Parental gave significantly ($P<0.05$) highest weight gain (1.61g). While, female and male Kainji parental gave significantly ($P<0.05$) lowest weight gain (1.50g).

Table 3: Growth performance of the fingerlings of four mating combinations from best 2006 year class intrspecific hybrids reared outdoor for two months.

Mating combination F x m	Initial weight (g)	Final pooled weight (g)	Weight gain (g)	Weight gain/day (g)	Initial pooled length (cm)	Final pooled length (cm)	Lenght increase (cm)	Length increase /day (cm)
KKF $_1$ X KKF $_1$	0.34^{b}	2.42^{b}	2.08	0.048	1.87^{a}	8.73^{c}	6.86	0.16
KKF $_1$ X KK parental	0.43^{a}	2.27^{b}	1.84	0.043	1.81^{a}	8. 38c	6.57	0.15
KK parental x KKF $_1$	0.61^{a}	4.43^{a}	3.82	0.089	1.67^{b}	10.07^{b}	8.40	0.20
KK parental x KK parental	0.50^{ab}	4.83^{a}	4.33	0.101	1.64^{b}	11.45a	9.81	0.23

Table 3 further shows the weight parameters in all the mating combinations for a period of two months culture in outdoor 2x2x1m3 concrete tanks. Statistical investigations shows significant difference ($P<0.05$) between the mating combinations. The female and male Kainji parental gave the best weight gain (4.33g), while the female Kainji

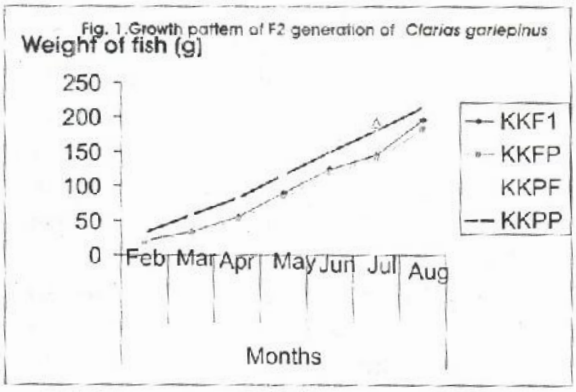
F_1 crossed with male Kainji parental gave significantly ($P<0.05$) weight gain of 1.84g. The female and male Kainji parental which gave the least growth (1.50g) in indoor rearing became the best (4.33g) after 43 days of rearing outdoor. In addition, the female Kainji F_1 and male Kainji parental which gave the best weight gain (1.61g) indoor became the least (1.84g) after two month of outdoor rearing.

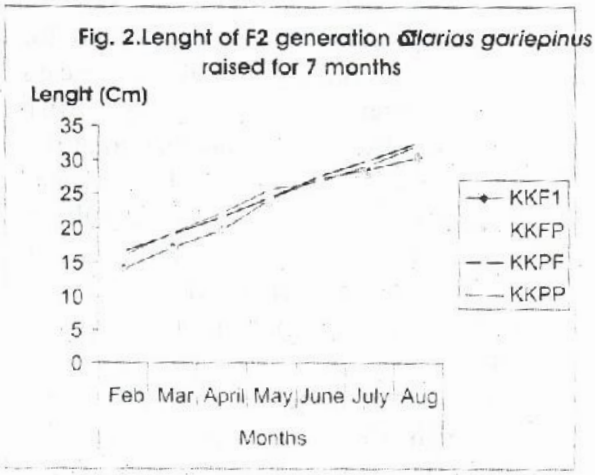
The lenght parameters in both indoor and outdoor tanks showed statistically significant difference ($P<0.05$) between the mating combination (table 2 and 3). The indoor rearing shows that female and male Kainji F_1 gave the highest lenght increase of 1.69cm, while female Kainji parental and male Kainji F_1 gave the least length increase of 1.45cm. The two month outdoor rearing shows that female and male Kainji recorded the highest lenght increase of 9.81cm and female Kainji F_1 crossed with male Kainji parental gave the least (6.57cm) lenght increase.

Fig.1 shows seven month growth pattern of F_2 generation of *Clarias gariepinus* generated from four mating combinations of the best 2006 year class intraspeicifc hybrids. The female Kainji parental crossed with male Kainji F_1 gave the highest growth performance (222.49g), followed by female and male Kainji parental crosses which recorded 214.64g). The least growth (180.66g) was recorded in the cross involving female Kainji F_1 and male Kainji parental.

Fig. 2. The offspring of female Kainji parental crossed with male Kainji F_1 gave the highest length increase of 32.42cm, this combination also recorded the highest weight gain. The cross involving female Kainji F_1 and male Kainji parental which recorded the least weight gain also recorded the least length increase of 30.32cm. The female Kainji F_1 and Male Kainji parental which recorded superior growth indoor was overtaken by female and male Kainji parental at two month outdoor rearing, but at the end of 7 months outdoor growth, female Kainji F_1 and male Kainji parental regain its superiority in growth performance. This might be because of low adaptability to outdoor environmental conditions at the initial stage.

The growth rate is easy to record as body weight or body length. This trait has great economic importance and is probably the most important for all breeding programs and all species (Refstie, 1986). Several works have indicated that the catfish species can be hybridized to produce offspring with varying characters (Boonbrahm *et al;* 1977; Hecht and Lublinkhof, 1985; Tarnchalanukit, 1986; Mukho Padathy and Dehedrai, 1987; Legendre *et al*; 1992 cited by Nlewadim, 2002). The result obtained in this study indicated that the growth pattern of the F_2 offspring of the various mating combinations had minimal variations during their early stages of growth (table 1) and at the end of the grow-out period (Fig. 1)..





CONCLUSION

The best growth performance recorded in the cross involving female Kainji parental and male Kainji F_1 might be indication of genetic improvement.

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